

Appl. No. 10/631,124
Response dated 02/28/06
Reply to Office Action of 11/02/05

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of the Claims:

1. (currently amended) A single acentric, rhombohedral lanthanide borate crystal ~~comprising~~ having the formula LnBO_3 , wherein Ln is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y, and having a dimension of at least 1 mm in at least one direction, made by the process comprising the steps of:

providing a pressure vessel having a growth zone and a dissolving zone;

providing a seed crystal having the formula LnBO_3 ,
wherein Ln is selected from the group consisting of Pm, Sm, Eu,
Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y;

positioning the seed crystal in the growth zone of the pressure vessel;

providing a medium comprising powdered LnBO_3 and at least one member selected from the group consisting of aqueous hydroxide ions, aqueous carbonate ions, soluble nitrate anions, soluble fluoride anions, soluble chloride anions and combinations thereof in the dissolving zone; and

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heating and pressurizing the vessel such that a growth temperature is produced in the growth zone, a dissolving temperature is produced in the dissolving zone, and a temperature gradient is produced between the growth zone and the dissolving zone, whereby growth of the crystal is initiated, the growth temperature ranging from about 300°C to about 500°C, the dissolving temperature ranging from about 450°C to about 600°C, the temperature gradient ranging between about 10°C and about 100°C between the warmer dissolving zone and the cooler growth zone, and the pressure ranging from about 5 kpsi to about 30 kpsi.

2. (original) The lanthanide borate crystal set forth in claim 1 wherein the crystal exhibits non-linear optical properties.
3. (currently amended) An acentric, rhombohedral lanthanide borate crystal as set forth in claim 1 comprising wherein the step of providing a seed crystal having the formula LnBO_3 , wherein Ln is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y comprises providing a seed crystal having the formula $\text{Ln}_y\text{Ln}_x\text{BO}_3$, wherein Ln_x is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y and wherein Ln_y is selected from the group consisting of La, Ce, Pr, Nd, Y, Pm, Sm, Eu, Gd, Tb, Dy,

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Ho, Er, Tm, Yb, Lu and Cr and mixtures thereof, wherein Ln_x and Ln_y are differing ions and wherein the molar ratio of $Ln_y:Ln_x$ is from about 1:99 to about 20:80.

4. (original) The lanthanide borate crystal set forth in claim 3 comprising an active gain medium for a laser.

5. (original) The lanthanide borate crystal set forth in claim 4 wherein the lasing crystal comprises a self-frequency doubler.

6. (canceled) A method for growing a single rhombohedral lanthanide borate crystal comprising :

reacting B_2O_3 and Ln_2O_3 , wherein Ln is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y, in an aqueous solution at a temperature of from about 350°C to about 600°C and at a pressure of from about 8 kpsi to about 30 kpsi.

7. (canceled) The method set forth in claim 6 wherein the step of reacting B_2O_3 and Ln_2O_3 comprises reacting B_2O_3 , $(Ln_x)_2O_3$, and $(Ln_y)_2O_3$ wherein Ln_x is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y and wherein Ln_y is selected from the group consisting of La, Ce, Pr,

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Nd, Y, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu and Cr and mixtures thereof, wherein Ln_x and Ln_y are differing ions and wherein the molar ratio of $(\text{Ln}_x)_2\text{O}_3$ and $(\text{Ln}_y)_2\text{O}_3$ to B_2O_3 is 1:1 and wherein the molar ratio of $(\text{Ln}_x)_2\text{O}_3$ to $(\text{Ln}_y)_2\text{O}_3$ is from about 99:1 to about 80:20.

8. (canceled) A single acentric, rhombohedral lanthanide borate crystal comprising the formula LnBO_3 , wherein Ln is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y, made by the method comprising:

reacting B_2O_3 and Ln_2O_3 , wherein Ln is selected from the group consisting of Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y, in an aqueous solution at a temperature of from about 350°C to about 600°C and at a pressure of from about 8 kpsi to about 30 kpsi.

9. (canceled) The lanthanide borate crystal set forth in claim 8 comprising a dimension of at least 1 mm in at least one direction.